Atmos. Chem. Phys. Discuss., 11, C5879–C5882, 2011
www.atmos-chem-phys-discuss.net/11/C5879/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Springtime carbon episodes at Gosan background site revealed by total carbon, stable carbon isotopic composition, and thermal characteristics of carbonaceous particles" *by* J. Jung and K. Kawamura

Anonymous Referee #2

Received and published: 2 July 2011

This paper shows very interesting use of 13C isotope data and thermal characteristics of the carbonaceous aerosol fraction to explain the origin of carbonaceous aerosol on a small island in Korea. It is one of the most conclusive studies using 13C data on aerosols that I have seen so far and the subject is definitely relevant for ACPD. There are some issues that require clarification and a few points where the interpretation of the data seems questionable, which will be discussed below. Since these points do not affect the main conclusions of the paper I suggest publication, subject to minor revisions.

Major comments: 1) The division and subdivision of the different episodes needs to be described more clearly. Reading through the whole paper, this is what I think was done, although I am not completely sure:

(a) First a general subdivision of cases with elevated carbon concentrations (=carbon episodes) using a cutoff of 10ug/m3.

Then the carbon episodes were further subdivided in

b) Pollen cases (identified by high loadings of pollen present on the filter)

c) LRT (identified by elevated PM10 concentrations?)

d) LRT + dust (identified by elevated PM 10 concentrations + high Ca + low alpha?)

I think it necessary to be more clear on the following issues:

(a) Cutoff of 10ug/m3 for carbon episodes: (i) why was this cutoff chosen? (ii) If this was the main criterion, why is there a "pollen episode" in figure 5 with a TC concentration < 10ug. Does this mean the presence of pollen took precedence over the criterion of 10ug/m3. Where the other non-episode cases pollen free? (iii) Did the non-event cases also sometimes have back trajectories from China or did the back trajectories come from elsewhere?

(b) Pollen cases: (i) What was the exact criterion for a sample to be classified as "pollen enriched" e.g. how many pollen on the filter? Was there a relatively gradual transition from non-episodes to pollen episodes, or was there a very clear cutoff? (ii) Did the pollen cases also sometimes have back trajectories from China? I.e. what was done with the cases that showed both pollen on the filter as well as LRT characteristics?

(c) How exactly were the LRT cases classified? (i)Were they just the cases of carbon episodes that were not pollen enriched? Or were they selected based on PM10 or back trajectories? (ii) Were there any carbon episodes that showed neither LRT nor pollen characteristics?

ACPD

11, C5879–C5882, 2011

(d) Dust episodes: Are the MODIS pictures that are presented just an illustration for one day, or was this analysis done for all cases and used to identify the dust episodes?

The division of cases has to be made very clear (maybe even with the help of a drawing, but at least with a clearly divided list) in the beginning of the paper.

2) I think the subdivision between LTP_EC and LTP_NEC cases is not too well justified (the back trajectories are not so extremely different, since most of them start in NEC). The divison does not add much to the scientific content of the paper. There are few LTP data points anyway and subdividing then into even smaller subcases just raises questions about the statistical validity of the conclusions. The few differences that are observed (for just 2 data points in the LTP_EC case) could also be due to different meteorological conditions during transport or other influences. Unless it is a priori known that aerosols in EC and NEC differ very strongly and this difference is also seen in the data here, I would strongly advise to just omit this subdivision. It will only make the main conclusions of this paper stronger.

3) The non-event cases should be included in Table 2 and Table 3 for the sake of comparison (one line with average non-event values would be sufficient.) This is especially important since the “carbon episodes” are defined against the non-event cases and the non-event cases are also included in some of the figures. This would probably also clarify some of the questions raised in point 1.

4) The weaker Asian dust episode seems a bit questionable: Apart from low alpha and high Ca, all other characteristics (PM10, isoptopes, carbonates, thermal evolution, etc. . . blend in well with normal LRT data). This can also be seen in the figures where the strong dust episode is often an outlier, whereas the weak dust episode usually lies among the LRT data points. This might mean that a weak dust episode does not strongly affect the other aerosol characteristics (or maybe that it was a normal LRT episode?) This should be discussed in the paper a bit more clearly.

5) Figure 5a. The strong correlations observed in these Figure are mainly due to two

ACPD

11, C5879–C5882, 2011

outlier data points at very high concentrations. The interpretation of this figure should be used with great caution and the conclusions are not entirely reliable.

6) p 12883, line 26: In my opinion a likely reason for the diverging delta13C TC values are is the variability of the delta 13C of non pollen carbon (see e.g. Figure 6a), which is seen more strongly at low citric acid concentrations.

7) Figure 11: If the LRT cases are not subdivided then it can be said that the LRT cases have a relatively constant OC2, and a strongly variable OC1 fraction. This could also be an effect of aging during transport and might not necessarily reflect the different sources. In any case a regression slope derived from of 2 or 3 data points is largely meaningless (page 13886, line 11).

8) In the pollen cases, OC1 and OC2 are highly correlated and I am surprised this is not discussed more detail, considering how much discussion is spent on the statistically weaker data points.

9) Page 13887: I think this paragraph is too speculative, especially regarding the role of dust in SOA formation. It is impossible to conclude this from two data points, where one of them is in my point of view not even very clearly a dust episode.

10) Figure 12: If the pollen mostly evolve at the OC2 temperature step, do you have any explanation for the strong correlation between OC1 and OC2 in the pollen cases?

11) This paper needs to be corrected by a native speaker, before it can be published

---

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 13867, 2011.